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Effects of Increased Working Memory Load on Performance of Language Tasks in Aphasia

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Introduction.

Verbal STM impairments are invariably present in aphasia and can affect retention of semantic and/or phonological representations of words. The close association between STM and language impairments is evident in many aspects of language performance. We investigated the relationship of impaired semantic and phonological STM and performance on language tasks with variations in memory load conditions.

Method and Predictions.

Twenty individuals with chronic aphasia (variety of types and severity) and 10 controls participated. Two judgment tasks, synonymy and rhyming, were administered under two memory load conditions using an ABBA design. We also examined whether measures of access to (processing) and/or maintenance of (STM) semantic and phonological representations would predict effects of working memory load on language performance.

Memory Load

3-choice (High) *Memory Load* - compare meaning (or sound) of three words and decide which two are most similar (or rhyme).

2-choice (Low) *Memory Load* - decide which of two words is closest in meaning (or rhymes) with a third word.

The difference in performance on 3- and 2-choice memory load conditions constitutes the detrimental effect of working memory load on performing the language task.

Prediction: Performance on 2-choice judgments will be significantly better than on 3-choice judgments (correcting for chance).

Predictor variables

Semantic STM and Phonological STM Probe Spans: A sequence of words is presented followed by a probe word. Participant decides if probe is categorically-related to (Semantic STM) or rhymes (Phonological STM) with a word in the sequence.

Semantic processing: A spoken word-to-picture matching task (*Peabody Picture Vocabulary Test III,* Dunn & Dunn, 1997) was used to assess access to semantics from spoken words.

Phonological processing: A phoneme discrimination task using nonwords in a minimal pair judgment task

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was used to assess input phonological processing.

Predictions: Semantic STM span will predict a working memory load effect on the synonymy judgment task. Phonological STM span will predict a working memory load effect on the rhyming judgment task.

Results (Table 1).

T-tests comparing performance on 3-choice (high) and 2-choice (low) memory load conditions: Performance is significantly better in the 2-choice memory load condition. This result takes into account differences in chance probabilities of correct responses in the two tasks (2-choice: 50%; 3-choice: 33%).

Multiple regression analyses: Semantic STM predicted a significant effect of memory load on performance of Synonymy Judgments (concrete words). There was a trend for phonological STM to predict an effect of memory load on performance of Rhyming Judgments. Measures of semantic and phonological processing did not emerge as predictors of a memory load effect on these judgment tasks.

Discussion. Increasing working memory load adversely affects performance on language tasks in persons with aphasia, but not in controls. Whereas semantic and phonological *STM* abilities provide a good estimate of a person's sensitivity to increased working memory load tasks, measures of *access* to language representations do not.

References.

Dunn, L. & Dunn, L. (1997) *Peabody Picture Vocabulary Test III.* San Antonio: Pearson.

Table 1. Results of Statistical Analyses of Synonymy and Rhyming Judgment Tasks

I. T-tests Comparing Proportion Correct in Low and High Memory Load Conditons

Judgment Task	T-Test Result
Concrete Synonymy:	$t(19) = 8.22$, $p = .000$
Abstract Synonymy:	$t(19) = 3.81$, $p = .001$
Rhyming Judgments:	$t(10) = 3.75$, $p = .001$

II. Mutiple Regression Analyses

Test	Predictor Variables
Concrete Synonymy:	Semantic STM $p = .04$
Abstract Synonymy:	None
Rhyming Judgments:	Phonological STM $p = .09$